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WATER RESOURCES STUDY OKATIBBEE CREEK RESERVOIR, LAUDERDALE COUNTY, MISSISSIPPI: STUDY OF NEED FOR AND VALUE OF STORAGE OF WATER FOR QUALITY CONTROL

Public Health Service
Atlanta, Georgia

April 1964

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WATER RESOURCE STUDY
OKATIBBEE CREEK RESERVOIR
LAUDERDALE COUNTY, MISSISSIPPI

Study of Need for and Value
of Storage of Water for Quality Control

Prepared for
U. S. Army Engineer District, Mobile
Corps of Engineers

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Division of Water Supply and Pollution Control
Atlanta, Georgia

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INTRODUCTION

AUTHORITY

In April 1961, the Public Health Service published its report on municipal and industrial water supply requirements from the proposed Okatibbee Creek Reservoir in Mississippi. Subsequently, in a letter dated 21 January 1963, the U. S. Army Engineer District in Mobile, Alabama, requested the Public Health Service, Region IV Office to conduct a supplemental study related to water quality storage requirements in the Okatibbee Creek Reservoir. The letter requested ".....that a definite determination be made of dilution water requirements for pollution abatement....." Performance of this study was made in accordance with Section 2(b) of Public Law 84-660 as amended by PL 87-88, the Federal Water Pollution Control Act.

PURPOSE AND SCOPE

Determination of the need for and value of storage in the proposed Okatibbee Creek Reservoir for water quality streamflow regulation was the primary purpose of this study. The proposed reservoir (Figure 1 in rear of report) will be located in Lauderdale County near Meridian, Mississippi. Stream reaches 39 miles long on Okatibbee Creek, 1 mile on Chunky Creek, 72 miles on the Chickasawhay River, and 8 miles on Sowashee Creek were considered in the streamflow regulation need evaluation. The streams studied are part of the Pascagoula River Basin.

For the projection of streamflow regulation needs, a period of 50 years was used, i.e. to the year 2015. The multi-purpose project life as planned by the U. S. Army Corps of Engineers, Mobile District, was also 50 years.

ACKNOWLEDGEMENTS

Numerous agencies and officials were very cooperative during the study. Included in this group are the following: U. S. Army Corps of Engineers (Mobile District), U. S. Geological Survey (Surface Water Branch in Jackson, Mississippi), Mississippi State Board of Health, Mississippi Game and Fish Commission, Mississippi Board of Water Commissioners, City of Meridian Officials, and plant officials from the industries involved in the study. Acknowledgement is gratefully made for their advice and assistance.

SUMMARY AND CONCLUSIONS

SUMMARY

1. Okatibbee Creek Reservoir's proposed location is seven miles northwest of Meridian, Mississippi, in Lauderdale County, approximately 28 miles above the mouth. The reservoir is being considered by the Corps of Engineers for flood control, water supply, streamflow regulation, and recreational use.
2. A study area selected for determining water quality control benefits extends from the proposed damsite downstream to Quitman, Mississippi. This area is located in Lauderdale and Clarke Counties. The critical stream reach from the water quality standpoint was found by field studies to be approximately 14 miles on Okatibbee Creek from the mouth of Sowashee Creek to the Chunky Creek confluence.
3. The principal wastewater sources are the City of Meridian and its associated industries. The present waste load after treatment is estimated to be 14,700 pounds of ultimate biochemical oxygen demand (BOD) per day with a waste flow of 5.3 million gallons per day (mgd). Before treatment the load is 22,100 pounds ultimate BOD per day.
4. A stream survey was conducted in and adjoining the study area (as far downstream as Waynesboro, Mississippi) to aid in determination of water requirements for quality maintenance. Emphasis was placed on the dissolved oxygen (DO) and BOD parameters; however, other pertinent chemical and bacteriological data were collected from streams and waste sources.

5. Survey results indicated that water above waste sources was of good quality. Okatibbee Creek was found to be incapable of assimilating the present pollutional load during low flow periods. The critical stream reach was devoid of oxygen during those periods.

CONCLUSIONS

1. Assuming treatment with 85 percent BOD (and settleable solids) removal as adequate treatment, waste loads in the study area for the year 2015 were estimated as 13,100 pounds of ultimate BOD per day. Waste flow was projected as 20 mgd.
2. Desirable water quality in the study area was determined to be controlled by the well-rounded, warm water fish habitat parameter of 4.0 milligrams per liter (mg/l) DO.
3. Computations showed that the base flow (the minimum of monthly mean flows occurring once in ten years) was not sufficient to maintain the desired water quality and that storage in the Okatibbee Creek Reservoir would be needed for streamflow regulation in 2015.
4. A draft on storage in the amount of 19,600 acre-feet per year was estimated for maintenance of water quality. Releases would vary seasonally and should be controlled through use of a water quality monitoring system.
5. The benefit value of storage in 2015 was estimated by the least cost alternate method as $98,700 annually. Principal beneficiaries would be the residents of Meridian and Lauderdale County in Mississippi. The projected population of Lauderdale County is estimated to be 116,000 in 2015; 104,900 in Meridian.

DESCRIPTION OF PROJECT

RESERVOIR SITE

The proposed site for the Okatibbee Creek Dam is seven miles northwest of Meridian in Lauderdale County on Okatibbee Creek, 38 miles above the mouth (Figures 1 and 2 in rear of report). Pine Springs Community is adjacent to the damsite. Runoff would be collected for storage from a 154 square mile drainage area above the dam. The purpose of the dam is to control floods along the lower reaches of Okatibbee Creek, to provide storage for municipal and industrial water supply in the Meridian area, and to provide water recreation facilities for the area.

STREAM CHARACTERISTICS

Okatibbee Creek rises near the Neshoba-Kemper County line, northwest of Meridian, Mississippi, and drains an area of 367 square miles along the border of these two counties and the western half of Lauderdale and Clarke Counties. The basin has a maximum length of 39 miles and an average width of ten miles. The creek, which is about 55 miles long, has a fall of 24 feet per mile for the uppermost five miles beginning at the divide, and an average of three feet per mile for the remaining length of the stream. It flows in a southeasterly direction to its junction with Chunky Creek. The principal tributary is Sowashee Creek which enters Okatibbee Creek southwest of the City of Meridian. The stream channel is 60 to 100 feet wide with banks 10 to 20 feet high and a bankfull capacity of about 2000 cfs in the lower reaches. The minimum, maximum, and average flows of record near Meridian are 3.3, 27,000, and 371 cfs respectively.

As a part of the Pascagoula River system, Okatibbee Creek joins Chunky Creek to form the Chickasawhay River which joins the Leaf River to form the Pascagoula River. Ultimately the Pascagoula River flows into the Gulf of Mexico.

A more detailed discussion of streamflow characteristics within the study area are contained in the STREAM QUALITY MAINTENANCE section.

WATER QUALITY

Laboratory analyses were performed on samples obtained from Okatibbee Creek near the damsite. The quality of water at that point was good. Total dissolved solids averaged 60 milligrams per liter (mg/l) and the hardness was only 12 to 16 mg/l, indicating very soft water. Coliform most probable number per 100 milliliters (MPN/100 ml), the fecal pollution indicator, rose and fell in association with peaks of stream runoff. The bacteriological quality of water for water supply purposes from the proposed reservoir would be expected to meet the 5000 MPN/100 ml limit[1/] for a raw water source; that is, if it is assumed that an increase in fecal contamination would be limited following reservoir construction.

Downstream from the damsite, water quality remained essentially unchanged until wastes were introduced from the Meridian area. A stream survey performed to aid in calculations for water quality storage is discussed in Appendix A, and a description of water quality below Meridian is described therein. The chemical and bacteriological data collected during the study is presented in tabular form in Appendix C.

1/ This limit is for Group III waters, those requiring complete rapid sand filtration together with postchlorination as described in the Public Health Service, Manual of Recommended Water-Sanitation Practices, 1946.

PERTINENT PROJECT DATA

Tentative pertinent data for Okatibbee Creek Dam is summarized below:

Drainage area - 154 square miles

Maximum spillway design pool elevation - 362 ft. MSL

Reservoir area at spillway crest - 7500 acres

Total volume at spillway crest - 109,800 acre-feet

Length of dam - 6620 feet

DESCRIPTION OF STUDY AREA

LOCATION AND BOUNDARIES

The study area is located in Lauderdale and Clarke Counties (Figure 2, rear of report). The study area boundary generally follows the watershed boundary from the proposed damsite to the mouth of Okatibbee Creek. Then it follows the stream channel downstream to Quitman on the Chickasawhay River. This study area was selected since it includes the major tributaries to Okatibbee Creek and also the section of stream to be benefited most by water quality control.

During the stream survey described in a later section, it was discovered that treated and untreated waste discharges from the Meridian - Lauderdale County area adversely affected water quality in certain reaches of the above streams. The areas most influenced by the wastes were the lower half of Sowashee Creek, Okatibbee from the mouth of Sowashee to the Chunky Creek confluence, and Chickasawhay River to Quitman, Mississippi, (some effects of pollution were detected as far downstream as Waynesboro, Mississippi). Inasmuch as projected 2015 waste loads (pounds ultimate BOD/day) were similar to those existing during the 1963 survey, it was concluded that the study area selected should approximate the same stream reaches affected by present waste loads. The reach below the dam to the mouth of Sowashee Creek was also included. The critical stream stretch which was calculated to be most affected by waste loads, and to be benefited most by streamflow regulation, is shaded on the map.

GEOGRAPHY

The Pascagoula River system lies within the East Gulf Coastal Plain which is subdivided into four physiographic regions, one of which is of interest to this study. The North Central Plateau region in which the study area lies encompasses the northern part of the basin. Topography is characterized by streams with fairly deep, broad valleys flanked by high ridges and hills 400 to 600 feet above sea level. These hills are very prominent near Meridian. All of Chunky, Sowashee, and Okatibbee Creeks and the upper 30 miles of the Chickasawhay River lie in this region.

CLIMATE

The study area has a temperate, humid climate with short, usually mild winters and long, warm summers typical of the Gulf Coast region. Severe cold spells are infrequent and freezing temperatures, although they occur often, are of short duration.

Rainfall within the basin is heavy and, in general, well distributed throughout the year.

Meridian reports the following mean temperatures for winter, summer, and the year respectively: 48.8, 80.2, and 64.5° F. Average growing season is 246 days and the mean annual precipitation 55 inches.

PRINCIPAL COMMUNITIES AND INDUSTRIES

The municipality of Meridian, Mississippi, dominates the urban portion of the study area. In 1960 the census population for Meridian was 49,374 (most of which is sewered). Downstream from Meridian are two other urban areas of note which are included in the study area. These are Enterprise, unsewered, and Quitman, sewered. Respective 1960 populations for these

communities were 532 and 2030 (approximately 1800 on sewer system). Only wastes from the Meridian area and urbanized and/or industrialized portions of Lauderdale County were found to affect quality in study area streams.

Within the study area are a number of waste producing industries. Principal of these are a wood preserving plant, an asphalt roofing manufacturer, and a wallboard producer. Total employment of the three is reported as 725 workers. Although there are other waste producing industries in Meridian, most of these are connected to the municipal sewerage system. They contribute a minor waste load in comparison with the three above-mentioned industries.

THE ECONOMY

The April 1961 report, Municipal and Industrial Water Supply Storage Requirements, Okatibbee Creek Reservoir, Meridian, Mississippi, discussed economics of the Meridian-Lauderdale County area in much detail. Projections made are considered valid and are summarized below for Meridian:

	1960	2015
Number of People Employed	18,950	37,800
Number in Labor Force	19,700	39,400
Total Population	49,375	104,900

The economy of Lauderdale County and Meridian was expected to change from predominantly agricultural to a more balanced industrial-agricultural nature. In 1960 the population of Lauderdale County was 73.5 percent urban. It is anticipated that the county will be 90 percent urban in 2015.

WATER REQUIREMENTS

A portion of the April 1961 report showed projections of 2015 water requirements. It was reported that municipal and industrial water use in 1960 in the study area was 7.2 million gallons per day (mgd). Of this total, recent field studies showed 5.3 mgd returned to study area streams in the form of treated and untreated wastewater. Projected 2015 waste flows were 20.0 mgd of the total 25.0 mgd water use.

STREAM QUALITY MAINTENANCE

The use of water will almost inevitably result in the production of some liquid wastes which, even after a high degree of treatment, will degrade the quality of the receiving stream. It is essential that recognition be given to the need for flows which must be maintained in the receiving stream if the quality of its waters is to be kept at reasonable levels. Estimates of these streamflow needs have been made to assist in determination of the need for water quality streamflow regulation below the proposed Okatibbee Creek Reservoir. The maintenance of streamflows at levels indicated is considered to result in quality conditions which are acceptable to responsible state agencies. State agencies with water pollution control responsibilities in Mississippi are the Mississippi Game and Fish Commission and the Mississippi State Board of Health.

Provision of the recommended storage for streamflow regulation is needed to maintain dissolved oxygen (DO) concentrations in the order of five to six mg/l, or higher, except for one month out of ten years, when the dissolved oxygen is purposely predicted to drop below 4.0 mg/l (but not to level which would introduce septic conditions) at the point in the

receiving waters where the maximum effect of pollution is felt, just upstream from the mouth of Chunky Creek. This minimum value of 4.0 mg/l is required for support of warm water fish such as the bass and panfish found in the study area. The Mississippi Game and Fish Commission has set a lower limit for dissolved oxygen in Mississippi waters at 3.0 mg/l. However, they have indicated an anticipated change in this value. The Mississippi State Board of Health has indicated endorsement of a minimum value of 4.0 mg/l. Maintenance of a minimum dissolved oxygen value is assumed to be the controlling water quality criteria. Bacterial concentrations can be effectively controlled through adequate waste treatment, while dissolved solids concentrations in the critical 500 mg/l range were never observed and are not predicted to be exceeded.

Mention is made above of the one in ten year return period selected for occurrence of less than or equal to 4.0 mg/l dissolved oxygen. Consideration was given to other return periods, namely, once in five years and once in twenty years. Experience has shown that if a sport fish population should be killed on the average of once in five years, a resultant population predominated by undesirable rough fish could occur. Also it is possible that sport fish could be lost for a full year, twenty percent of the five year period, if kill occurred during critical spawning or migration periods. Thus, the once in five year period was rejected as undesirable.

The one in twenty year return period was also rejected. It was found that the amount of storage required for this long return interval could not be economically provided at the proposed site. Flow estimates were not considered reliable for the one in twenty period due to the limited amount of long term stream gaging data available from the area.

In addition to the minimum dissolved oxygen concentration selected, it was assumed for purposes of projection, that a minimum of 85 percent BOD removal will be provided for both municipal and industrial wastes. Other types of waste, e.g. storm water runoff, are considered uncollectable. Eighty-five percent is the average removal that can be expected from secondary waste treatment in the southeast.

Water Quality Survey

In mid-November 1963, a month-long stream survey in and adjacent to the study area was initiated. The purpose of the stream survey was to provide the necessary data for projection of water requirements for stream quality maintenance. A detailed description of the survey is contained in Appendix A.

2015 Streamflow Regulation Needs

The waste load projected to 2015, assuming 85 percent BOD removal, is 13,000 pounds of ultimate BOD per day with a waste flow of 20 mgd. This is slightly less than the present load of 14,700 pounds with a waste flow of 5.3 mgd. It should be remembered that the present pollutional load includes that contributed by three industries providing little waste treatment, thus the higher total present load.

With the basic assimilative factors calculated according to procedures discussed in Appendix A, it remained to determine the future need for streamflow regulation for water quality control, especially in the critical stream stretch. The base flow which should be maintained at all times without benefit was selected as the mean minimum monthly, once in ten year flow. Having estimated a 13,000 pound ultimate BOD loading in the year 2015, it was determined that a draft on storage from the proposed

reservoir, above that needed for continuous base flow, would be needed to maintain water quality. The draft on storage needed was estimated to be 19,600 acre-feet per year (ac-ft/yr). Studies indicated that base flow would be adequate for water quality maintenance only during the cold weather months, e.g. November through March.

Considering the total amounts of flow needed to maintain water quality on an annual basis, with the spring-fall seasons assumed to be average, it is estimated that hot weather flows would be 200 percent of average and cold weather flows 20 percent. This is due of course to the seasonal variation in pollution-assimilative elements.

In order to determine the desired rate of water release from storage, it will be necessary to maintain a water quality monitoring system in the critical stream stretch. Such a system might be a cooperative endeavor of appropriate State and local government agencies.

Continuous releases from the dam for maintenance of base flow and water quality control should contain sufficient dissolved oxygen for maintenance of a well-rounded fish population, i.e. 4.0 mg/l.

WATER QUALITY CONTROL BENEFITS

Water quality control benefits are defined as the net contribution to public health, safety, economy, and effectiveness in use and enjoyment of water for all purposes which are subject to detriment or betterment by virtue of change in water quality.

Projected pollutional loads (assuming adequate treatment as 85 percent BOD removal) are very close to present loads, so that little imagination is necessary to picture future conditions and recognize likely benefits due to water quality control.

Fishing and swimming are common in Okatibbee Creek above Station 10. In talking to residents it was learned that a wide variety of species of fish are caught, varying from bass to catfish. Fishing was observed at Stations 4, 6, 7, and 9 on several occasions during the survey period. Station 4, it was learned, is a very popular "swimming hole" for the local children. Conditions would be improved with control of streamflow.

This upstream stretch appears to be and is of considerably better quality than observed from Stations 10 to 14. This stream section is recognized visibly by the residents as being grossly polluted. Residents questioned what could be done to clean up the stream. Most of them were especially interested in restoring fish life to these waters.

Fishing was also reported below Station 14 at Enterprise. However, there were complaints of fish kills as far downstream as Quitman. During low flow periods the critical section of the stream becomes devoid of oxygen and fills with sludge deposits. High runoff carries the sludge, which is scoured from the bottom, downstream. The sudden decline in

quality of the water is capable of killing the aquatic life in the stream. During the latter part of November, a fish kill following a sudden rain was noted, especially at Station 15. Small dead fish were noted as far downstream as Quitman. There were reports of large amounts of dead fish a short distance below Station 15. According to the U. S. Fish and Wildlife Service, fishing in the critical stream reach alone in the year 2010 would amount to 2500 fisherman-days.

There are numerous steel bridges that cross Okatibbee Creek and also many farm structures close to the stream. Hydrogen sulfide and other gases resulting from septic conditions deteriorate paint and result in increased maintenance cost of these structures.

In addition to actual damage, putrefaction is a definite nuisance. The stream looks and smells bad when devoid of oxygen. This condition is not aesthetically acceptable to prospective residents or industries. When nuisance conditions exist, the stream can be a liability. If quality were improved, the stream could be a definite asset that would increase the value of property adjacent to the stream banks.

Public health and welfare liabilities due to the condition of study area streams are not all readily evaluated but are definitely potential. The Public Health Service recommends a maximum coliform MPN of 5000/100 ml for Type III domestic water supply sources. A limit of 1000 MPN/100 ml for water contact sports is also generally accepted by various health agencies. In addition to disease potential, polluted waters create an adverse psychological effect on people living and working in an uninvitable environment.

The quality objectives and related flow requirements recommended in this report are therefore designed for achievement of the following:

1. Protection of public health and welfare.
2. Prevention of nuisance conditions.
3. Provision of an environment suitable for the propagation of fish and other aquatic life.
4. Enhancement of the aesthetic values of the streams and adjacent areas.
5. Sustainment and protection of the agricultural and industrial productive wealth of the basin and to support the continued expansion of industrial and agricultural development and population growth.
6. Protection of bridges and other structures near the stream.

As mentioned previously the controlling quality objective is for provision of a healthy fish habitat. The primary beneficiaries of the proposed water quality control program are the resident population in the urban and rural areas adjacent to Okatibbee Creek and the Chickasawhay River above Quitman, especially in the Meridian-Lauderdale County area. Some benefits, e.g. aesthetic, could be recognized as far downstream as Waynesboro during low flow periods however. By virtue of the multiplicity of values (tangible and intangible) that are derived through maintenance of stream quality and the large number and varied nature of the people to whom these benefits accrue, the benefits attributable to measures specifically designed to achieve water quality control through flow regulation may be regarded as widespread and in harmony with both State and national goals for pollution control.

VALUE OF BENEFITS

Various methods have been proposed for the economic evaluation of water quality control ben fits. Since both tangible and intangible benefits would accrue from water quality control, a dollar value is often hard to assign to the benefits. However, the generally accepted method of measuring the minimum value of benefits is to determine the least cost alternative for achieving the same results were the project not to be constructed.

Several alternates to the proposed project were considered:

1. A single purpose (only for streamflow regulation to control water quality) reservoir at the proposed site.

2. A single purpose reservoir on Chunky Creek with required flow for water quality control being pumped to Okatibbee Creek.

3. Construction of sewer and pumping station to transport treated waste to the Chunky Creek confluence with Okatibbee Creek.

4. Construction of a holding pond for storage of treated waste and release during high flows.

Alternate I

The first alternate listed was found to be the most feasible and least cost alternate. The single-purpose reservoir at the proposed project site would require 16,900 acre-feet of storage at an estimated cost of $2,360,000. Amortized over 50 years at 3 percent interest, the annual equivalent capital cost of this reservoir would be approximately $91,700. An estimated annual maintenance cost of $7,000 per year brings the total annual cost to $98,700.

The 1960 population of Lauderdale County (the greatest beneficiary) was approximately 67,000 with a projected population of 116,000 in the year 2015. The annual cost of this reservoir would be less than $1.50 per person per year at present, decreasing to less than $1.00 per person per year in 2015. Since there is an immediate need for streamflow regulation for water quality control, this benefit has not been discounted and is considered a minimum value of benefits attributable to water quality control storage in the proposed Okatibbee Creek Reservoir.

Alternate 2

The second alternate considered was a single purpose reservoir on Chunky Creek with required flow for water quality control being pumped to Okatibbee Creek. This site would require approximately one fourth less storage (due to larger drainage area) but would involve pumping up to 100 cfs for a distance of approximately seven miles. Cost for pumping and transmission with a 250 foot elevation difference between point of intake and discharge make this alternate infeasible. Total first cost was estimated at $2,860,000 with annual maintenance and power costs estimated to be $75,000; much higher than Alternate I.

Alternate 3

A third alternate considered was construction of an outfall line pumping station to transport all treated waste to the mouth of Okatibbee Creek. The total capital cost was estimated to be $1,900,000 with annual maintenance and operation cost estimated to be $76,000. Total annual cost was calculated as $148,000, again more costly than Alternate I.

Alternate 4

Construction of a holding pond for storage of treated waste and release during high flows was the last alternate considered. A 555 acre pond, ten feet deep would be required at an estimated cost of $2,044,000. Annual estimated operation and maintenance and equipment replacement is $21,000. The total annual cost of this project was calculated to be $101,000 which makes it only slightly more costly than Alternate I.

Least Cost Alternate (Value of Benefit)

Evaluation of alternates has resulted in selection of Alternate I, the single purpose reservoir constructed at the proposed project site, as the least costly. The annual cost of this alternate, $98,700, is a measure of the total annual benefit in the year 2015 for water quality - streamflow regulation from the proposed Okatibbee Creek Reservoir. The estimated annual benefit is categorized below (3 percent amortization for 50 years):

Annual equivalent capital cost	$91,700
Annual operation and maintenance cost	7,000
	$98,700

This benefit value has not been discounted due to an immediate need for streamflow regulation.

APPENDIX A

WATER QUALITY SURVEY

APPENDIX A

WATER QUALITY SURVEY

In mid-November 1963, a month-long stream survey in and adjacent to the study area was initiated. The purpose of the stream survey was to provide the necessary data for projection of water requirements for stream quality maintenance. Location of sampling stations is shown in Figure 1, and a listing of station descriptions may be found in Appendix B. Mississippi State Highway Department maps were used to locate the stations and for stream mileage measurements. Stream mileage was measured from Station 20 at Waynesboro.

Special attention was directed toward the dissolved oxygen and BOD characteristics since they were of primary importance in projecting conditions in the stream. Dissolved oxygen samples were fixed and iced in the field. BOD samples were composited for analysis. Since little diurnal variation was observed in dissolved oxygen, the stream was usually sampled only two times per day. In addition to DO and BOD samples, chemical and bacteriological samples were also collected from key stations. Analysis data are contained in Appendix C.

The primary sources of pollution were studied in order to better determine the present waste loads discharged to the stream. These waste loads enter Sowashee Creek (see Figure A-1) which later joins Okatibbee Creek just above Station 10. In addition to the treated effluent from the City of Meridian sewage treatment plant, there were three major industrial sources of pollution: an asphalt roof manufacturing plant, a wood preserving plant, and a paper products plant. For purposes of discussion these industries shall be denoted as Industry 1, Industry 2, and

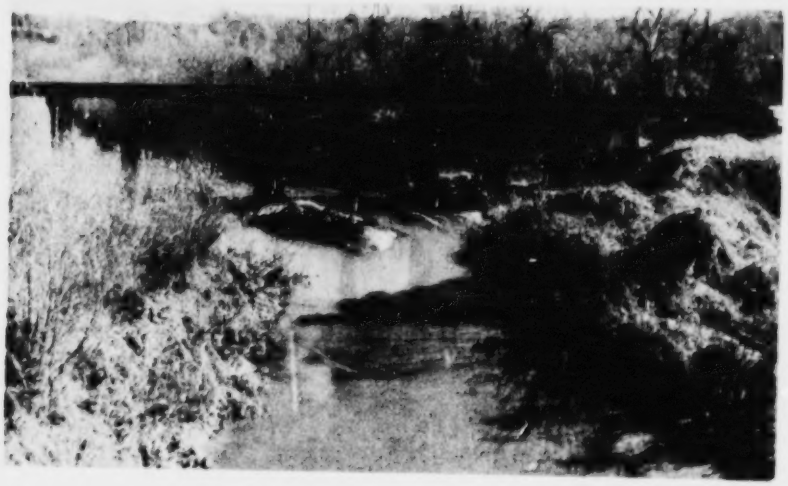

Figure A-1
Waste Flow Entering Sowashee Creek.

Industry 3, respectively. Sharp crested weirs were constructed in the waste ditches leading from these plants for measurement of waste flows (see Figure A-2). Composites were weighted according to flow for BOD analyses. Additional flow measurements were made over several periods of time on different days so that an average waste load could be determined.

In order to compute the time of passage between stream stations, reference points were established, usually on bridges, so that the water elevation could be measured. The stream was cross-sectioned so that the area of flow could be determined. With five U. S. Geological Survey gaging stations (three in study area) providing flow measurements of the streams, the velocity and consequently, time of passage, was calculated.

Chemical and bacteriological analyses were performed at the Meridian waste treatment plant and Public Health Service, Jackson, labs according to the procedures outlined in Standard Methods for Examination of Water and Wastewater.

Although the period of study was short, a very wide range of stream conditions was observed. Conditions were observed ranging from very low flows, 25 cubic feet per second at Station 13, and above average temperature to the opposite extreme. In general the water quality was very poor during the low flow, above average (20° C) temperature period observed and greatly improved with increased flows and decreased temperatures. During low flows the dissolved oxygen concentration dropped to zero at Station 10 and remained at zero to just above Station 14 (below the mouth of Chunky Creek). A distance of approximately 14 miles was devoid of oxygen with 19 additional stream miles, to Station 16 at Quitman being

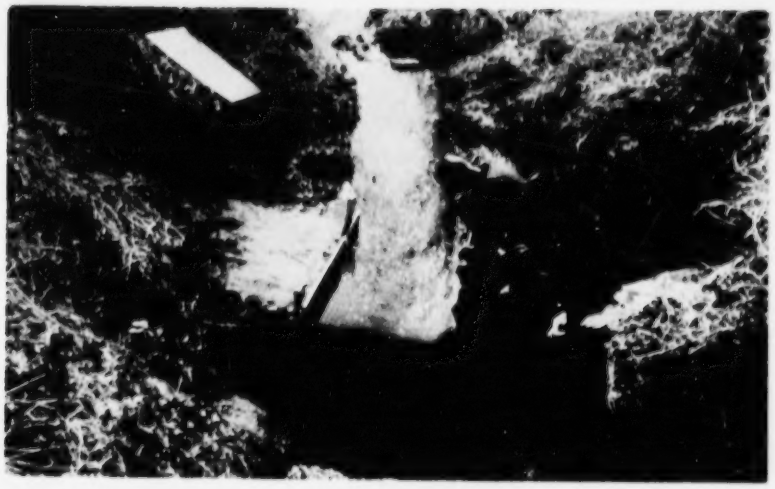

Figure A-2
Waste Flow Measurements.

required to raise the level to 4.0 mg/1. The stream continued to improve below Quitman, and 100 percent saturation was noted at Station 20 (at Waynesboro).

During comparatively high flow and low temperature periods, the dissolved oxygen declined to a low of only 72 percent saturation in the critical stream reach (Stations 10 to 14), rising to 92 percent at Station 14. Figure A-3 depicts extremes of observed DO values.

Figure A-4 presents the coliform results for two different flow patterns. On December 3, when flow was 98 cfs at Station 14, the coliform density was affected by surface runoff as shown by the high counts (24,000 MPN/100 ml) above Station 10. On December 5, the streamflow was steady, 77 cfs at Station 14. The MPN/100 ml rose sharply to 1,600,000 at Station 10, but dropped rapidly to 79,000 at Station 13. Under stable flow conditions the bacteriological population distribution in the stream was normal for one main source of pollution.

Long term (up to 15 days) BOD determinations were made on samples from stream and industrial waste sources so that the rate of deoxygenation and ultimate BOD values could be determined. The ultimate BOD values were used to determine the present pollutional load discharged to the stream.

The major pollutional load consists of the load contributed by the sewage treatment plant and three industries as previously outlined. The City of Meridian discharges approximately 3.7 mgd of treated sewage with an estimated ultimate BOD of 29 mg/1 (5-day BOD of 20 mg/1) for an average pollutional load of 906 pounds of ultimate BOD per day. The following table summarizes the present pollutional load contributed by the three industries.

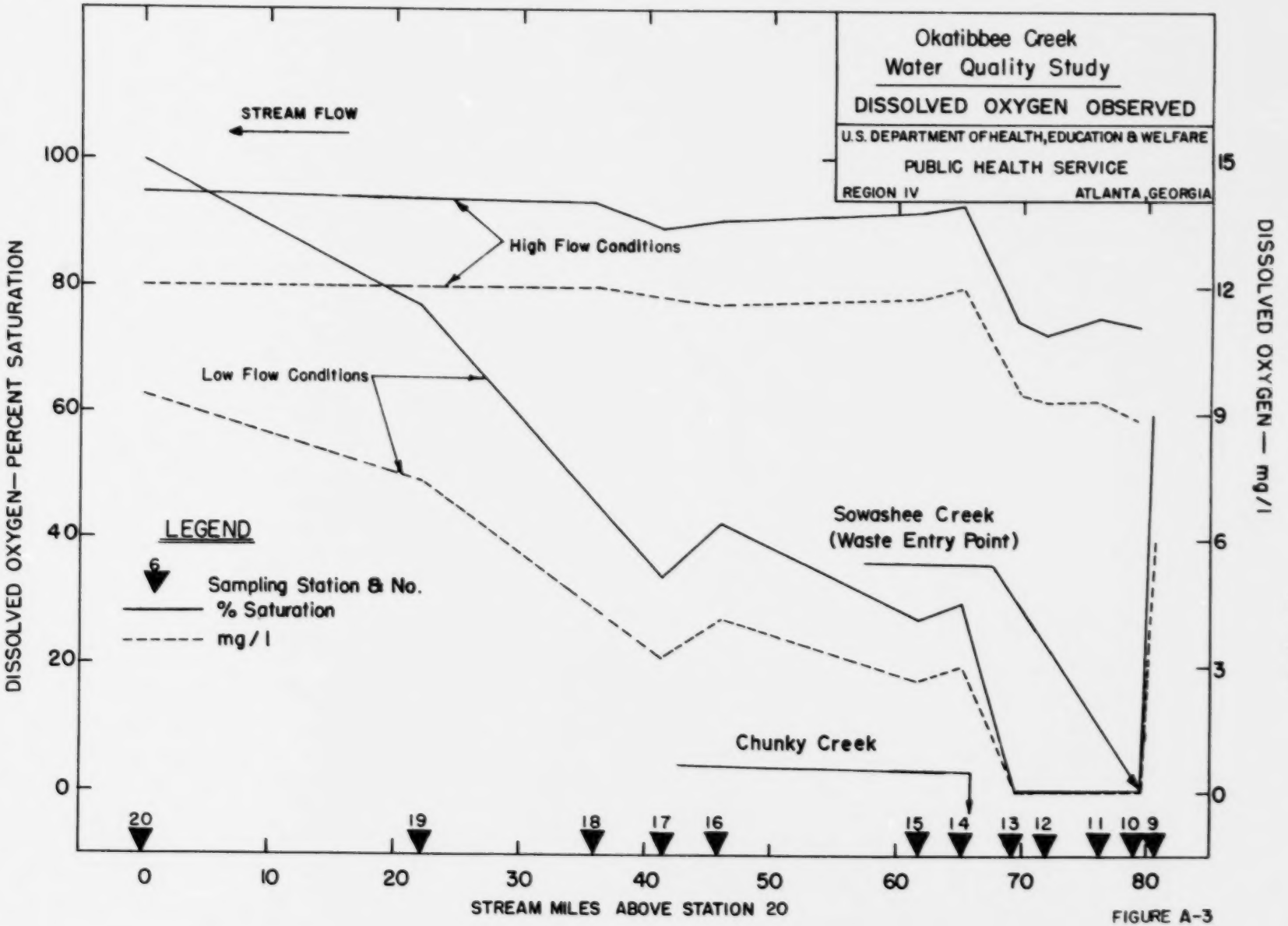

FIGURE A-3

H-4a

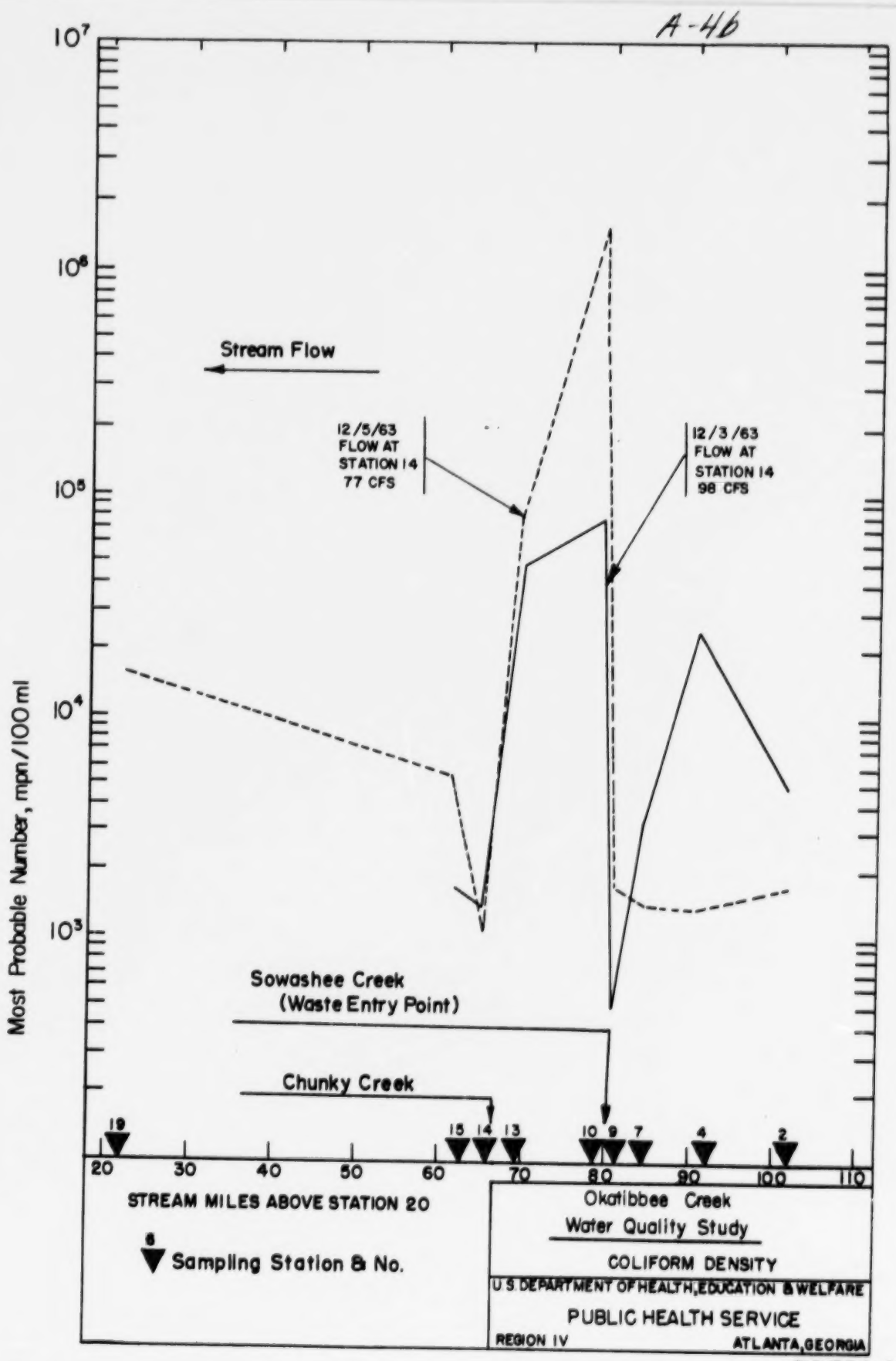
Most Probable Number, mpn/100 ml
10^7
10^6
10^5
10^4
10^3
Stream Flow
12/5/63
FLOW AT
STATION 14
77 CFS
12/3/63
FLOW AT
STATION 14
98 CFS
Sowashee Creek
(Waste Entry Point)
Chunky Creek
19
15 14 13
10 9 7
4
2
20 30 40 50 60 70 80 90 100 110
STREAM MILES ABOVE STATION 20
6
Sampling Station & No.
Okatibbee Creek
Water Quality Study
COLIFORM DENSITY
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION IV
ATLANTA, GEORGIA

FIGURE A-4

Industry	Type Product	5-day BOD (mg/1)	Ultimate BOD (mg/1)	Flow (mgd)	Ultimate Load (#/day)
1	Asphalt roofing	610	760	0.16	1,014
2	Treated wood	2,520	3,810	0.022	697
3	Paper	650	1,000	1.44	12,100

The total combined pollutional load is 14,700 pounds of ultimate BOD per day with a waste flow of 5.3 mgd.

With the one day through 15 day BOD determinations, the deoxygenation constant, K_1, at 20° C, was calculated. Several procedures were used for checking purposes. The average of K_1's determined for the critical stream reach (Stations 10 to 14) was 0.1, which is the generally accepted value. This value was also supported by determinations of K_1 for the waste sources which also averaged 0.1.

To determine waste assimilative capacity in the critical stream stretch, December 10 and 15 were selected as "calculation dates" since they occurred with stable flow conditions and since sufficient analysis data were available for these two days. Observed dissolved oxygen values on these dates are shown in Figure A-5. Two commonly used mathematical models were tested for applicability to Okatibbee Creek: Velz Method and Streeter-Phelps Formulation. Streeter-Phelps Formulation correlated well with the data available for December 10 and 15, so was used for projection of conditions in 2015. Figure A-6 shows the observed and calculated dissolved oxygen curves for the critical stream reach. The reoxygenation constant, K_2, by the Streeter-Phelps method was calculated to be 0.25 at

the existing 5° C temperature and at projected flow levels. A more critical temperature of 30° C could occur during warm weather months, and at such times the K_2 constant was estimated to be 0.52; K_1, 0.16.

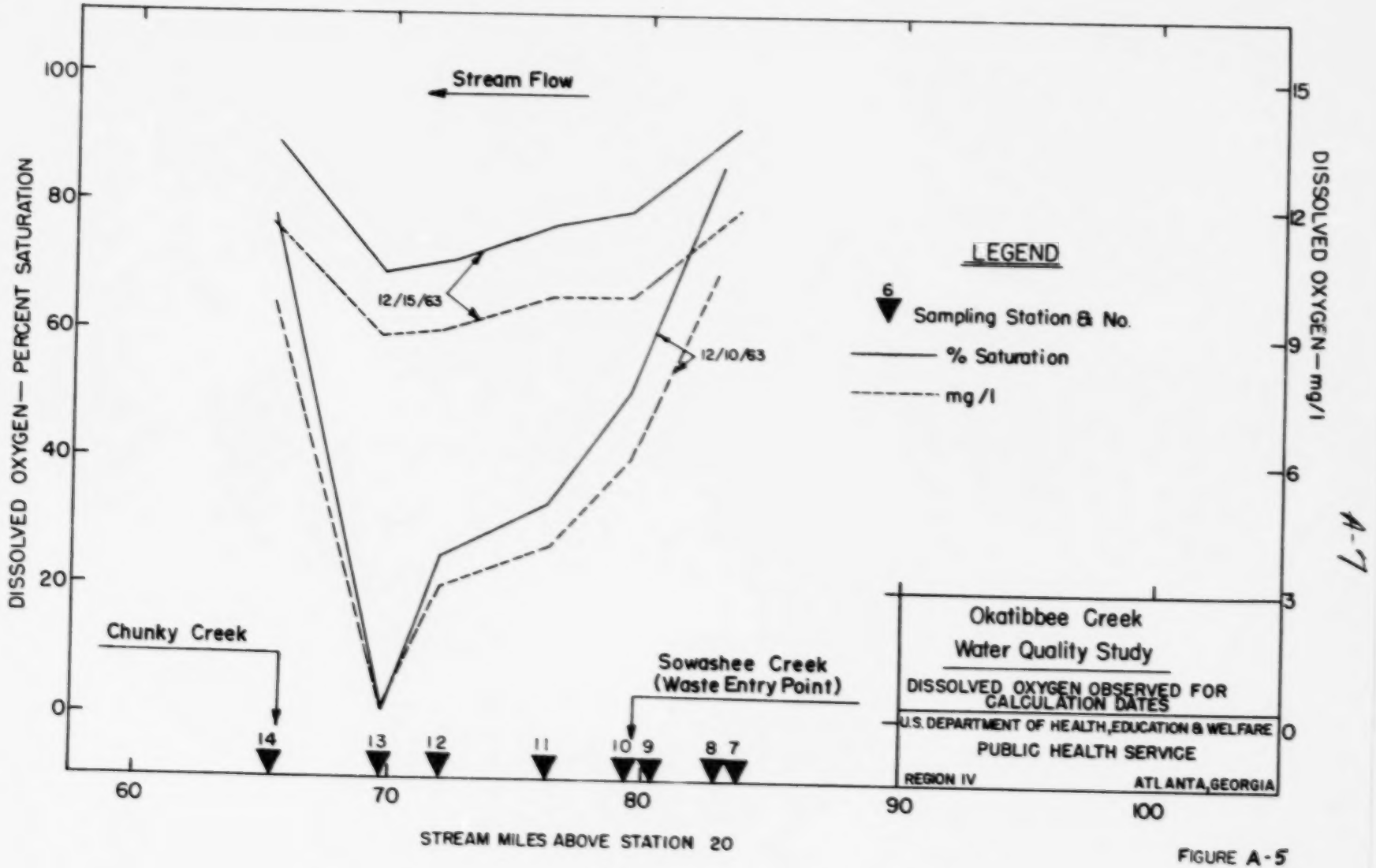
Stream Flow
DISSOLVED OXYGEN — PERCENT SATURATION
DISSOLVED OXYGEN — mg/l
100
80
60
40
20
0
15
12
9
6
3
0
12/15/63
12/10/63
LEGEND
6
Sampling Station & No.
% Saturation
mg/l
Chunky Creek
Sowashee Creek
(Waste Entry Point)
14
13
12
11
10
9
8
7
60
70
80
90
100
STREAM MILES ABOVE STATION 20
Okatibbee Creek
Water Quality Study
DISSOLVED OXYGEN OBSERVED FOR CALCULATION DATES
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION IV
ATLANTA, GEORGIA

FIGURE A-5

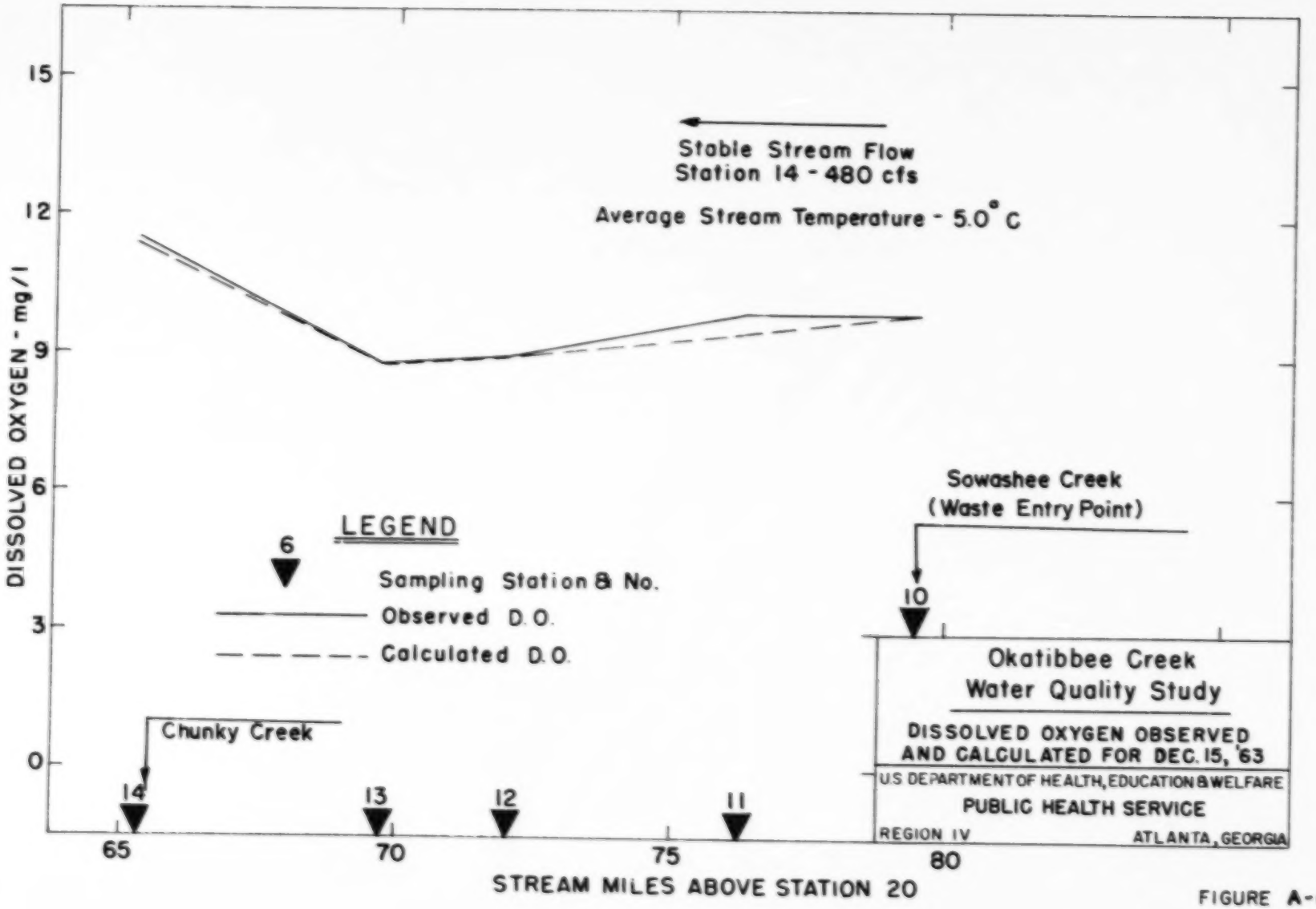
15
12
9
6
3
0
DISSOLVED OXYGEN - mg/l
Stable Stream Flow
Station 14 - 480 cfs
Average Stream Temperature - 5.0° C
LEGEND
6
Sampling Station & No.
Observed D.O.
Calculated D.O.
Sowashee Creek
(Waste Entry Point)
10
Chunky Creek
14
13
12
11
65
70
75
80
STREAM MILES ABOVE STATION 20
Okatibbee Creek
Water Quality Study
DISSOLVED OXYGEN OBSERVED
AND CALCULATED FOR DEC. 15, '63
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION IV
ATLANTA, GEORGIA

FIGURE A-6

APPENDIX B

DESCRIPTION OF SAMPLING STATIONS

A. Okatibbee Creek

Station 1 - Lat. 32° 36' 12", long. 88° 0' 18", in sec. 26, T.9 N., R. 15 E., at bridge on graded county road, 5 1/2 miles west of Miss. 493 just above normal reservoir limits, stream mile 104.1.

Station 2 - Lat. 32° 34' 42", long. 88° 48' 58", in sec. 1, T. 8 N., R. 14 E., at bridge on graded county road, stream mile 101.6.

Station 3 - Lat. 32° 31' 24", long. 88° 48' 06", in sec. 19, T. 8 N., R. 15 E., at bridge on graded county road, stream mile 97.6.

Station 4 - Lat. 32° 26' 45", long. 88° 46' 36" in sec. 16, T. 17 N., R. 15 E., at bridge on graded county road, 1.7 miles east of Miss. 19, downstream from proposed damsite, stream mile 90.9

Station 5 - Lat. 32° 25' 24", long. 88° 46' 15", in sec. 28, T. 17 N., R. 15 E., at bridge on graded county road, 0.4 miles east of Miss. 19, stream mile 88.8.

Station 6 - Lat. 32° 23' 48", long. 88° 45' 45", in sec. 4, T. 6 N., R. 15 E., at bridge on Miss. 19, 1.2 miles N. W. of Meridian City Limits, stream mile 86.9.

Station 7 - Lat. 32° 21' 15", long. 88° 45' 25", in sec. 22, T. 6 N., R. 15 E., at bridge on Old U. S. 80 in Meridian at USGS gaging station, 4 miles upstream from mouth of Sowashee Creek, stream mile 83.5.

Station 8 - Lat. 32° 20' 48", long. 88° 45' 12", in sec. 22, T. 6 N., R. 15 E., at bridge on U. S. 80 in Meridian, 3.4 miles above mouth of Sowashee Creek, stream mile 82.9.

Station 9 - Lat. 32° 18' 30", long. 88° 45' 30", in sec. 3, T. 5 N., R. 15 E., at bridge on U. S. 11, 0.6 miles south of Meridian City Limits, 0.9 miles above mouth of Sowashee Creek, stream mile 80.4.

Station 10 - Lat. 32° 17' 54", long. 88° 45' 12", in sec. 3, T. 5 N., R. 15 E., at bridge on graded county road, 0.8 miles east of U. S. 11, 0.1 miles below mouth of Sowashee Creek, stream mile 79.4.

Station 11 - Lat. 32° 15' 21", long. 88° 45' 18", in sec. 22, T. 5 N., R. 15 E., at bridge on graded county road, 1.0 miles east of U. S. 11, stream mile 76.2.

Station 12 - Lat. 32° 11' 55", long. 88° 45' 57", in sec. 4, T. 4 N., R. 15 E., at bridge on graded county road near Basic City, 0.9 mile east of U. S. 11, stream mile 72.0.

Station 13 - Lat. 32° 11' 45", long 88° 47' 18", in sec. 8, T. 4 N., R. 15 E., at bridge on county road between Basic City and Enterprise 2.5 miles north of Miss. 513, 3.9 miles above mouth of Chunky River, stream mile 69.7.

B. Chickasawhay River

Station 14 - Lat. 32° 10' 25", long. 88° 49' 18", in sec. 24, T. 4 N., R. 15 E., at bridge on Miss. 513 in Enterprise at stream gaging station, 0.5 mile below the mouths of Chunky River and Okatibbee Creek, stream mile 65.3.

Station 15 - Lat. 32° 7' 36", long. 88° 48' 54", in sec. 1, T. 3 N., R. 14 E., at bridge on paved county road, 1.4 miles west of Stonewall, stream mile 61.9.

Station 16 - Lat. 32° 02' 24", long. 88° 44' 42", in sec. 3, T. 2 N., R. 15 E., at bridge on paved county road near Quitman, 1.1 miles west of U. S. 45, stream mile 45.9.

Station 17 - Lat. 32° 00' 31", long. 88° 43' 15", in sec. 14, T. 2 N., R. 15 E., at bridge on U. S. 45, 1.5 miles south of Quitman City Limits, stream mile 41.3.

Station 18 - Lat. 31° 58' 15", long. 88° 42' 15", in sec. 31, T. 2 N., R. 16 E., at bridge on paved county road near DeSoto, 1.0 miles east of U. S. 45, stream mile 36.0.

Station 19 - Lat. 31° 51' 8", long. 88° 41' 12", in sec. 10, T. 10 N., R. 16 E., at bridge on U. S. 45, 0.2 miles south of Shubuta City Limits, stream mile 22.1.

Station 20 - Lat. 31° 40' 45", long. 88° 40' 59", in sec. 10, T. 8 N., R. 7 W., at bridge on U. S. 84 near Waynesboro, 2.8 miles west of U. S. 45, at site of discontinued USGS gaging station, stream mile 0.0.

C. Chunky River

Station 21 - Lat. 32° 11' 24", long 88° 49' 36", in sec. 13, T. 4 N., R. 14 E., at bridge on U. S. 11, 0.8 mile north of Enterprise City Limits, 0.7 miles above mouth of Chunky River.

D. Sowashee Creek

Station 22 - Lat. 32° 22' 24", long. 88° 40' 34", in sec. 26, T. 6 N., R. 15 E., at bridge on U. S. 45, 49th Street extended, in Meridian, 8.2 miles above mouth of Sowashee Creek.

Station 23 - Lat. 32° 19' 31", long. 88° 44' 2", in sec. 26, T. 6 N., R. 15 E., 0.8 mile east of U. S. 11, 50 ft. above outfall from City of Meridian Sewage Treatment Plant.

Station 24 - Lat. 32° 19' 30", long. 88° 44' 2", in sec. 35, T. 6 N., R. 15 E., 0.8 mile east of U. S. 11, 150 ft. below outfall from City of Meridian Sewage Treatment Plant.

Station 25 - Lat. 32° 18' 38", long. 88° 44' 31", in sec. 2, T. 5 N., R. 15 E., 0.8 mile east of U. S. 11, 0.9 mile above mouth of Sowashee Creek.

APPENDIX C
SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Manganese (mg/l)	Chloride (mg/l)	Coli MPN/ 100 ml	Hardness (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
1	11/20/63	1045	-	7.0	14	67.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	11/20/63	1025	-	7.4	14	71.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	6.4	10	-	-	4	1,300	8.0	0.0	8.0	53	29	15	82	
	11/29/63		-	-	-	-	-	7.0	11	-	-	12	9,200	11.0	0.0	11.0	70	16	12	86	
	12/3/63		-	-	-	-	-	7.1	7	-	-	-	4,900	13.2	0.0	13.2	79	18	18	97	
	12/5/63		-	-	-	-	-	-	-	-	-	-	1,720	10.9	0.0	10.9	53	17	15	70	
	12/12/63		-	-	-	-	-	-	-	0.16	0.00	-	-	-	-	-	-	-	-	-	
3	11/20/63	1005	-	5.2	14.5	50.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	11/20/63	940	-	4.9	15	48.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/25/63	1150	-	7.9	12	73.1	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	6.8	20	-	-	-	1,300	16.4	0.0	16.4	40	21	15	61	
	11/29/63	920	-	7.7	11.5	70	4.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1320	-	9.0	12	83.5	-	7.3	-	-	-	-	16,000	12.4	0.0	11.0	62	20	16	82	
	12/2/63	815	-	9.7	9	84	5.3*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1245	-	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	6.8	13	-	-	-	24,000	14.2	0.0	14.2	64	19	19	83	
	12/5/63		-	-	-	-	-	-	-	-	-	-	1,300	13.2	0.0	13.2	60	12	12	72	
	12/12/63		-	-	-	-	-	-	-	0.16	0.00	-	-	-	-	-	-	-	-	-	
	12/14/63		-	-	-	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	910	-	12.4	2	89.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1415	-	12.5	4	93.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	11/20/63	920	-	4.9	14	47.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	11/20/63	900	-	2.3	11	20.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	11/20/63	1135	-	7.0	16.5	71.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/25/63	1450	-	7.4	13.5	71.1	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	7.4	24	-	-	13	1,700	24.4	0.0	24.4	41	23	19	64	
	11/29/63	1015	-	7.7	13	72.5	5.1*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1350	-	7.0	14	67.5	-	7.4	22	-	-	15	92,000	20.4	2.0	18.4	100	133	30	233	
	12/2/63	845	-	9.3	9	80	3.1*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1315	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	7.2	18	-	-	-	3,300	19.4	0.0	19.4	63	20	20	83	
	12/5/63		-	-	-	-	-	-	-	-	-	-	1,410	14.8	0.0	14.8	64	20	18	84	
	12/12/63		-	-	-	-	-	-	-	0.21	0.00	-	-	-	-	-	-	-	-	-	
	12/14/63		-	-	-	-	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1000	-	11.9	4	90.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1455	-	11.9	5	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	935	-	12.4	3	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1435	-	12.4	4	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1140	-	13.1	2	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1550	-	13.0	3	96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	905	-	13.0	3	97.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1415	-	12.9	4	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1025	-	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	11/20/63	1200	3	8.8	18	92.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/25/63	1515	12	7.4	13	70.4	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1035	-	8.8	13	83	2.1*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1420	14	8.8	13	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	905	-	9.3	9	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1323	12	9.5	-	-	2.8*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1000	-	10.7	6	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1210	12	10.6	7	87	2.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	

SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Man-ganese (mg/l)	Chlo-ride (mg/l)	Coli MPN/ 100 ml	Hard-ness (mg/l)	Cal-cium (mg/l)	Mag-nesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
8	12/16/63	950	-	12.2	3	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(cont'd)		1450	45	12.5	3	93.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1130	-	12.8	3	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1540	-	13.0	3	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	935	-	13.0	3	97.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1400	-	12.9	4	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	11/20/63	1430	-	6.0	16	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	7.8	30	-	-	12	13,000	27.6	0.0	27.6	41	26	15	67	
	11/29/63	820	-	8.0	13	85.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1335	-	8.2	13	77.5	3.1*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1645	-	8.1	13	76.5	-	7.1	25	-	-	22	-	23.6	0.0	23.6	95	94	29	189	
	12/3/63		-	-	-	-	-	7.1	21	-	-	-	490	22.0	3.0	19.0	76	27	23	103	
	12/5/63		-	-	-	-	-	-	-	-	-	-	1,720	-	-	-	-	-	-	-	
	12/12/63		-	-	-	-	-	-	-	0.21	0.00	-	-	-	-	-	-	-	-	-	
	12/16/63	1100	-	12.0	4	91.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1625	-	12.4	4	94.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1100	-	12.0	4	91.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1625	-	12.4	4	94.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	11/20/63	1445	-	0.0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/23/63	1545	-	0.9	17	9.3	72	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	7.7	74	-	-	59	1,300,000	57.4	22.6	34.8	244	54	41	298	
	11/29/63	800	-	4.8	14	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1315	-	5.6	14	54	14*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1710	-	5.4	14	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	735	-	6.2	10	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1045	-	6.1	11.5	55.5	33*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	-	-	-	-	-	79,000	-	-	-	-	-	-	-	
	12/5/63		-	-	-	-	-	-	-	-	-	-	1,600,000	-	-	-	-	-	-	-	
	12/10/63	1105	-	6.0	8	50	20*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1315	-	6.1	9	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/12/63		-	-	-	-	-	-	-	0.34	0.00	-	-	-	-	-	-	-	-	-	
	12/15/63	1000	-	9.7	4.5	75.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1450	-	10.2	6	81.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	850	-	10.2	4	77.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1400	-	10.4	5.5	82.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	935	-	10.0	3.5	77.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1410	-	10.0	6.5	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1420	-	8.9	7.5	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1120	-	9.3	4	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	11/20/63	1500	-	0.0	19	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/25/63	1605	-	2.7	15	26.4	66	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1110	-	3.2	14	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1455	-	4.7	14	45	15.3*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	935	-	3.1	11	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1400	-	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/5/63		-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1120	-	4.0	7.5	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1335	-	3.9	8	33	24*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1020	-	9.6	4.5	74.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1510	-	10.1	5	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	910	-	10.5	4	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1430	-	10.6	5	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	955	-	10.4	3	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1430	-	10.3	5	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1445	-	9.3	6.5	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1135	-	8.6	4	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Man-ganese (mg/l)	Chlo-ride (mg/l)	Coli MPN/ 100 ml	Hard-ness (mg/l)	Cal-cium (mg/l)	Mag-nesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
12	11/20/63	1515	-	0.0	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/25/63	1645	-	1.8	14	17.3	24	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1130	-	0.0	14	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1520	-	0.0	14.5	0.0	30*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	1000	-	2.4	10	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1420	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/5/63		-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1005	-	2.4	8	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1205	-	3.6	8	30	14.8*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1040	-	8.8	5	68.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1530	-	9.3	5	72.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	930	-	10.0	4	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1505	-	9.8	4.5	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1010	-	10.0	3.5	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1445	-	10.1	4	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1500	-	9.3	5	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1150	-	7.8	4	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	11/20/63	1525	-	0.0	15	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	8.0	52	-	-	44	920,000	53.0	23.4	29.6	150	28	24	178	
	11/29/63	1150	-	0.3	14.5	3	19.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1545	-	0.6	14	6	-	7.3	64	-	-	63	920,000	53.0	15.0	38.0	205	73	42	278	
	12/2/63	1020	-	4.0	10	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1435	-	3.8	-	-	38*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	7.0	24	-	-	-	49,000	32.0	8.6	23.4	96	15	15	111	
	12/5/63		-	-	-	-	13.3	-	-	-	-	-	79,000	42.4	15.8	26.6	140	37	26	177	
	12/10/63	1025	-	0.0	8	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1220	-	0.6	8	0.5	42*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1100	-	8.6	5	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1545	-	9.0	5.5	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	945	-	9.7	4	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1520	-	10.4	5	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1025	-	10.0	4	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1455	-	9.9	4.5	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1515	-	9.5	5	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1205	-	7.9	3	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	11/20/63	1535	35	3.0	16	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		82	-	-	-	-	8.4	26	-	-	18	79,000	36.0	12.6	23.4	63	20	19	83	
	11/29/63	1135	-	7.4	13.5	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1725	127	3.7	-	-	20.5*	8.0	73	-	-	25	54,200	31.0	0.0	31.0	98	18	14	116	
	12/2/63	830	-	9.9	4	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1205	95	9.7	1	87.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		98	-	-	-	-	7.5	27	-	-	-	1,300	30.4	9.8	20.6	108	11	11	119	
	12/5/63		77	-	-	-	6.4	-	-	-	-	-	1,090	29.8	4.4	25.4	99	19	19	118	
	12/10/63	1045	-	9.7	6.5	78.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1235	85	9.6	6.5	78	5.7*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1115	-	11.2	5	87.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1600	480	11.7	5	91.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	1000	-	11.8	4	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1535	330	12.0	4	91.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1045	-	9.9	3.5	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1510	260	12.4	4.5	92.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	830	-	12.0	3.5	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1530	183	11.9	5	93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1220	165	12.0	3	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Manganese (mg/l)	Chloride (mg/l)	Coli MPN/ 100 ml	Hardness (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
15	11/20/63	1555	-	2.7	16.5	27	-	-	-	-	-	-	10,900	-	-	-	-	-	-	-	
	11/29/63	1120	-	5.8	14.5	56.5	3.3*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1710	-	5.9	-	-	-	-	-	-	-	-	7,000	-	-	-	-	-	-	-	
	12/2/63	850	-	8.4	14	80	2.9*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1225	-	8.3	11	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	-	-	-	-	-	1,700	-	-	-	-	-	-	-	
	12/5/63		-	-	-	-	-	-	-	-	-	-	5,420	-	-	-	-	-	-	-	
	12/10/63	1100	-	7.6	7.5	63	6.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1250	-	7.5	7.5	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	1015	-	11.5	4	87.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1545	-	11.6	4	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1100	-	11.8	4	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1525	-	11.7	4.5	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	805	-	11.4	4	86.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1555	-	12.3	5	97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	11/20/63	1620	-	4.1	17	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1050	-	6.8	13	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1635	-	6.8	-	-	3.1*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	915	-	6.1	10	54	5.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1300	-	6.5	11	58.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	915	-	11.6	4.5	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	11/22/63	905	-	3.2	19	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1030	-	6.5	13.5	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1615	-	2.2	-	-	2.0*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	930	-	6.4	10	56.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1325	-	6.9	10.5	61.5	12.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	935	-	11.7	4	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18	11/22/63		-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	1015	-	5.8	14	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1600	-	5.9	-	-	1.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	943	-	6.9	10.5	61.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1545	-	6.6	10.5	57	9.0*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1000	-	12.0	4.5	93.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19	11/22/63	1030	-	7.6	17.5	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/26/63		-	-	-	-	-	6.6	38	-	-	30	-	-	-	-	-	-	-	-	
	11/29/63	955	-	6.0	14	57.5	-	-	-	-	-	-	9,400	32.4	21.6	10.8	102	14	11	116	
		1530	-	7.4	-	-	3.0*	7.9	43	-	-	31	17,200	34.6	6.4	28.2	128	36	17	164	
	12/2/63	1010	-	8.8	11	79	2.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1420	-	9.4	11	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	7.2	27	-	-	-	-	28.8	3.0	25.8	100	12	12	112	
	12/5/63		-	-	-	-	-	-	-	-	-	-	16,000	28.8	4.0	24.8	93	12	12	105	
	12/18/63	1035	-	12.0	5	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20	11/22/63	1130	132	9.4	19	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	11/29/63	905	-	8.4	14	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1415	210	9.2	14	88.5	2.4*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	1040	-	9.9	11.5	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1505	237	10.3	11.5	95	6.9*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1110	611	12.0	5.5	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Manganese (mg/l)	Chloride (mg/l)	Coli MPN/ 100 ml	Hardness (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
21	11/26/63		-	-	-	-	-	8.4	22	-	-	15	700	26.3	15.6	10.7	73	2	2	75	
	11/29/63		-	-	-	-	1.9	7.8	17	-	-	14	3,480	34.4	0.0	34.4	79	15	13	94	
	12/2/63	815	-	11.2	13	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1130	-	11.1	13.5	106	0.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/3/63		-	-	-	-	-	7.2	17	-	-	-	3,480	22.4	1.0	21.4	66	13	13	79	
	12/5/63		-	-	-	-	-	-	-	-	-	-	2,400	21.0	0.0	21.0	60	10	10	70	
	12/10/63	1115	-	12.1	5.5	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	1040	-	12.8	4	97.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1605	-	13.1	4	99.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1120	-	13.8	3	102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1530	-	13.2	4	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1240	-	13.2	5	103	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
22	11/29/63	730	-	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1200	-	8.6	13	81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1620	16	8.4	13	79	3.7*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	910	-	7.7	9	66.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1305	1.6	7.9	10	76.5	3.2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1030	-	9.2	6	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1255	2.2	9.3	6.5	75	5.8*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1030	-	12.3	3	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1515	18	12.7	4	96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	1025	-	12.4	2	89.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1525	5.9	12.7	3	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1110	-	12.7	2	90.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1520	-	12.9	4.5	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	915	-	12.4	2	89.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1333	-	12.1	6	96.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1005	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
23	11/29/63	900	-	5.7	13	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1500	-	6.0	14	57.5	2*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	845	-	5.8	11	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1145	-	6.5	11	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1050	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1330	-	12.4	-	-	6.6*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1100	-	9.1	3	68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1540	-	10.3	6	81.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/16/63	1115	-	11.7	3.5	87.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1610	-	10.5	4	81.6	4.3*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1040	-	10.7	3.5	87.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1455	-	10.6	6	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	915	-	12.4	2	89.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	1030	-	10.9	2	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
24	11/29/63	930	-	6.4	16	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1440	-	6.7	19	71	16.0*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	1140	-	6.8	17	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
25	11/29/63	935	-	5.2	14	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1355	-	5.2	16	52	5*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/2/63	820	-	4.1	13	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1120	-	3.2	14.5	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/10/63	1025	-	5.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1310	-	5.3	-	-	>18*	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/15/63	1135	-	9.2	3.9	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1615	-	8.3	6.7	67.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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SUMMARY OF SURVEY DATA

Sta. No.	Date	Time	Flow (cfs)	Diss. Oxygen (mg/l)	Temp (°C)	% Sat.	5 day BOD (mg/l)	pH	M.O. Alkalinity (mg/l $CaCO_3$)	Iron (mg/l)	Man-ganese (mg/l)	Chlo-ride (mg/l)	Coli MPN/ 100 ml	Hard-ness (mg/l)	Cal-cium (mg/l)	Mag-nesium (mg/l)	Diss. Solids (mg/l)	Susp. Solids (mg/l)	Volatile Solids (mg/l)	Total Solids (mg/l)	Remarks
25 (Cont'd)	12/16/63	1050	-	8.1	8	68.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1640	-	6.8	10.5	68.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/17/63	1010	-	7.5	13	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		1425	-	7.4	10.5	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/18/63	1330	-	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12/19/63	955	-	7.9	8	66.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

* Composite

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STREAM BOD DATA

Station No.	Date Sample Collected	Type Sample	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	day 11	day 12	day 13	day 14	day 15	Estimated Ultimate First Stage
4	11/25/63	grab	-	-	-	-	4.0	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	0.7	-	-	-	4.2	-	-	-	-	5.7	-	-	-	-	6.0	6.0
	12/2/63	composite	-	-	-	-	5.3	-	-	-	-	-	-	-	-	-	-	-
	12/14/63	grab	0.6	0.9	1.4	2.0	1.9	2.2	2.9	3.0	3.1	3.2	3.4	3.6	4.4	4.4	4.6	3.7
7	11/25/63	grab	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	1.3	-	-	-	5.1	-	-	-	-	6.1	-	-	-	-	6.4	6.4
	12/2/63	composite	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-
	12/14/63	grab	0.4	0.7	0.9	1.2	1.7	1.7	2.0	2.2	2.2	2.4	2.8	2.8	4.0	4.6	5.0	2.8
8	11/25/63	grab	-	-	-	-	6.1	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	-	-	-	-	2.1	-	-	-	-	4.2	-	-	-	-	5.0	5.0
	12/2/63	composite	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
	12/10/63	composite	1.7	2.0	2.1	2.7	2.2	3.0	-	3.3	5.6	3.2	1.2	1.5	1.5	-	-	3.3
9	11/29/63	composite	1.0	-	-	-	3.1	-	-	-	-	6.3	-	-	-	-	6.8	6.8
10	11/25/63	grab	-	-	-	-	72	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	7.0	-	-	-	14.0	-	-	-	-	22.5	-	-	-	-	143	24
	12/2/63	composite	-	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-
	12/10/63	composite	17.6	34	30	42	20.0	32	24	50	57	53	47	40	20	-	120	36
11	11/25/63	grab	-	-	-	-	66	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	4.1	-	-	-	15.3	-	-	-	-	165	-	-	-	-	248	-
	12/5/63	grab	21	25	28	28	30	35	39	31	40	42	36	-	120	160	-	42
	12/10/63	composite	10	12.4	18	22	24	24	30	43	47	30	47	50	-	55	60	48
12	11/25/63	grab	-	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	10.8	-	-	-	30	-	-	-	-	230	-	-	-	-	280	-
	12/5/63	grab	3.5	10	10.5	18	16	16	26	32	34	-	50	23.3	-	70	55	53
	12/10/63	composite	6.0	8.8	12.8	14.8	14.8	16.8	-	27	30	32	38	40	44	44	48	44
13	11/29/63	composite	8.4	-	-	-	19.5	-	-	-	-	201	-	-	-	-	283	-
	12/2/63	composite	-	-	-	-	38	-	-	-	-	-	-	-	-	-	-	-
	12/5/63	grab	2.8	6.0	8.4	7.3	13.3	28.6	8.0	12.0	12.0	4.0	26	28	53	73	43	28
	12/10/63	composite	16.5	17.0	36	39	41	43	46	58	62	62	70	70	70	70	70	70
14	11/29/63	composite	4.3	-	-	-	20.5	-	-	-	-	29.7	-	-	-	-	140	30
	12/5/63	grab	0.9	3.4	5.0	7.2	6.4	4.4	13.3	13.6	-	12.0	13.0	14.0	34.0	36	42	14
	12/10/63	composite	2.2	2.7	4.1	5.1	5.7	10.4	10.8	12.4	13.6	14.0	14.4	17.6	18.8	20.8	24.4	14
15	11/29/63	composite	0.7	-	-	-	3.3	-	-	-	-	8.3	-	-	-	-	27	9.5
	12/2/63	composite	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
	12/10/63	composite	2.4	3.1	4.4	5.4	6.4	6.9	8.0	8.4	12.0	12.0	12.8	17.6	19.2	19.6	32	14.2
16	11/29/63	composite	0.8	-	-	-	3.1	-	-	-	-	5.6	-	-	-	-	6.4	6.4
	12/2/63	composite	-	-	-	-	5.2	-	-	-	-	-	-	-	-	-	-	-
17	11/29/63	composite	0.5	-	-	-	2.6	-	-	-	-	4.6	-	-	-	-	5.7	5.7
	12/2/63	composite	-	-	-	-	12.4	-	-	-	-	-	-	-	-	-	-	-
18	11/29/63	composite	0.3	-	-	-	1.6	-	-	-	-	3.4	-	-	-	-	4.0	4.0
	12/2/63	composite	-	-	-	-	9.0	-	-	-	-	-	-	-	-	-	-	-
19	11/29/63	composite	0.7	-	-	-	3.0	-	-	-	-	4.5	-	-	-	-	12.5	4.5
	12/2/63	composite	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-	-	-

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STREAM BOD DATA

Station No.	Date Sample Collected	Type Sample	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	day 11	day 12	day 13	day 14	day 15	Estimated Ultimate First Stage
20	11/29/63	composite	0.7	-	-	-	2.0	-	-	-	-	4.4	-	-	-	-	5.4	5.4
	12/2/63	composite	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-
21	11/29/63	grab	0.8	-	-	-	1.9	-	-	-	-	3.2	-	-	-	-	4.4	4.5
	12/2/63	composite	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-
22	11/29/63	grab	0.9	-	-	-	3.7	-	-	-	-	6.1	-	-	-	-	6.8	6.8
	12/2/63	composite	-	-	-	-	5.2	-	-	-	-	-	-	-	-	-	-	-
	12/10/63	composite	2.7	3.7	4.5	5.2	5.8	5.9	6.2	-	6.3	6.3	7.3	8.0	8.1	8.1	12.6	6.3
23	11/29/63	composite	4.8	-	-	-	28	-	-	-	-	68	-	-	-	-	77	77
	12/10/63	composite	7.0	4.2	5.4	6.0	6.6	7.0	8.5	11.5	12.0	13.0	16.0	17.0	18.0	18.5	21.5	19
	12/16/63	composite	-	-	-	-	4.3	-	-	-	-	-	-	-	-	-	-	-
24			5.6	-	-	-	16	-	-	-	-	63	-	-	-	-	103	32
25		grab	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-
	11/29/63	composite	14.4	-	-	-	53	-	-	-	-	120	-	-	-	-	840	112
	12/10/63	composite	>36	>36	134	260	>158	>168	>168	217	217	223	223	210	220	230	320	230

INDUSTRIAL WASTE SOURCE DATA

Industry	Date Sample Taken	Type Sample	Average Flow MGD	Ave. Temp °C	Day 1 mg/l	Day 5 mg/l	Day 10 mg/l	Day 15 mg/l	Estimated Ultimate First Stage mg/l	Phenols and/or Substituted Phenols mg/l	Remarks
I	12/3/63	grab	-	-	-	-	-	-	-	1.04	
	12/5/63	2½ hr. comp.	0.17	32.0	102	320	410	580	-	-	
	12/12/63	2½ hr. comp.	0.23	-	120	900	1003	3413	-	-	
	average		*0.16	32.0	111	610	706	1996	760	-	Pollutional load based on average of composites.
II	12/3/63	grab	-	-	30	170	1180	2040	-	18.36	
	12/5/63	½ hr. comp.	0.025	-	130	1490	1760	1860	-	-	
	12/12/63	3 hr. comp.	0.029	16.5	820	2700	3650	6250	-	4.06	
	average		*0.022	16.5	722	2520	3380	5620	3810	-	Pollutional load based on time weighted average of composites.
III	12/3/63	grab	-	-	126	500	910	1370	-	1.60	
	12/6/63		-	28.4	-	-	-	-	-	-	
	12/12/63	3 hr. comp.	2.18	27.9	125	650	880	1190	-	0.93	
	12/16/63	grab	-	-	-	321	-	-	-	-	
	average		*1.44	28.2	125	650	880	1190	1060	-	Pollutional load based on composite.

I - Asphalt roofing plant
II - Wood preserving plant
III - Paper products plant

*Note: These flow figures are daily averages based on flow measurements taken at different times on several different days.

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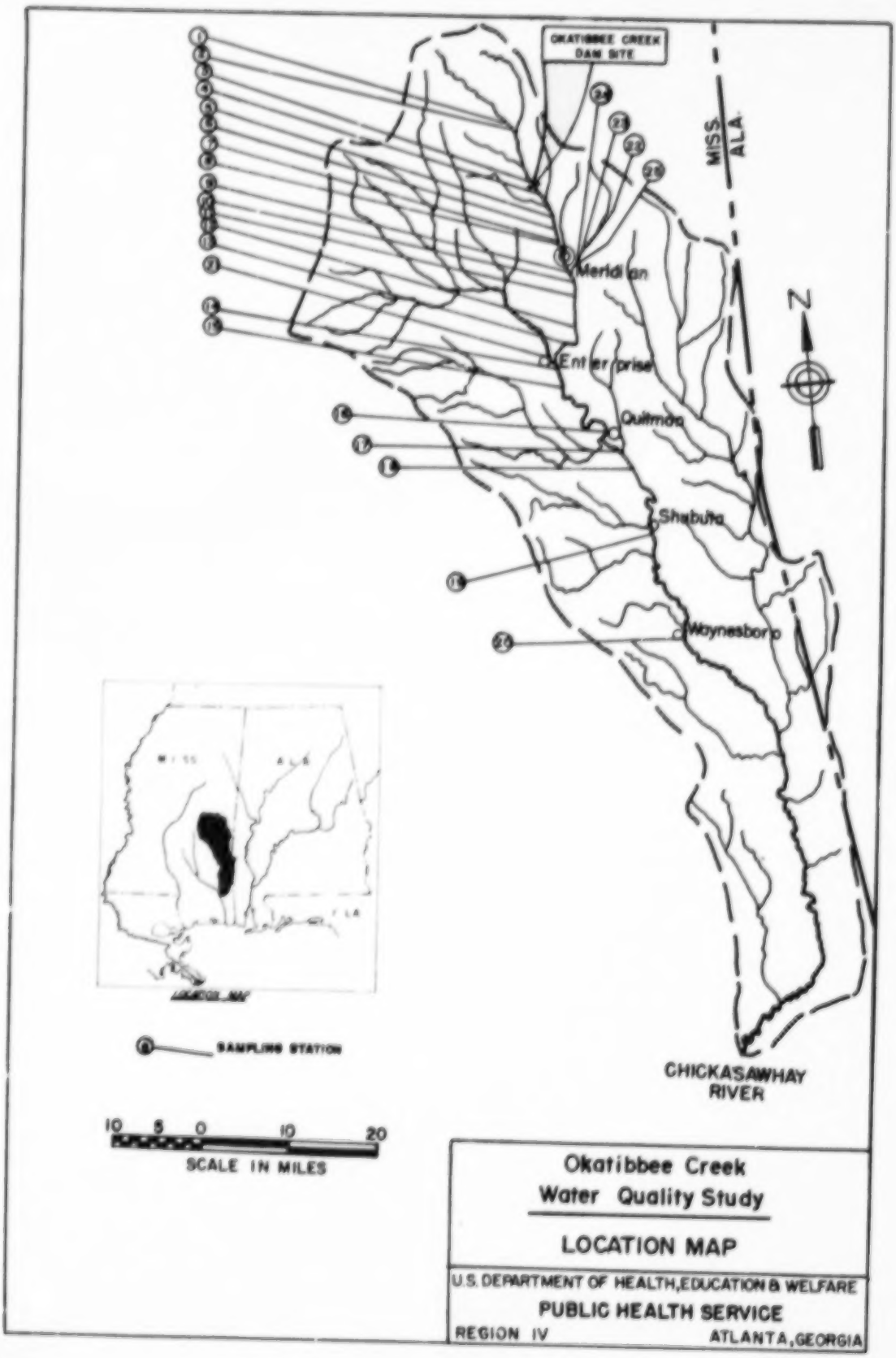

Okatibbee Creek
Water Quality Study

LOCATION MAP

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA

FIGURE 1

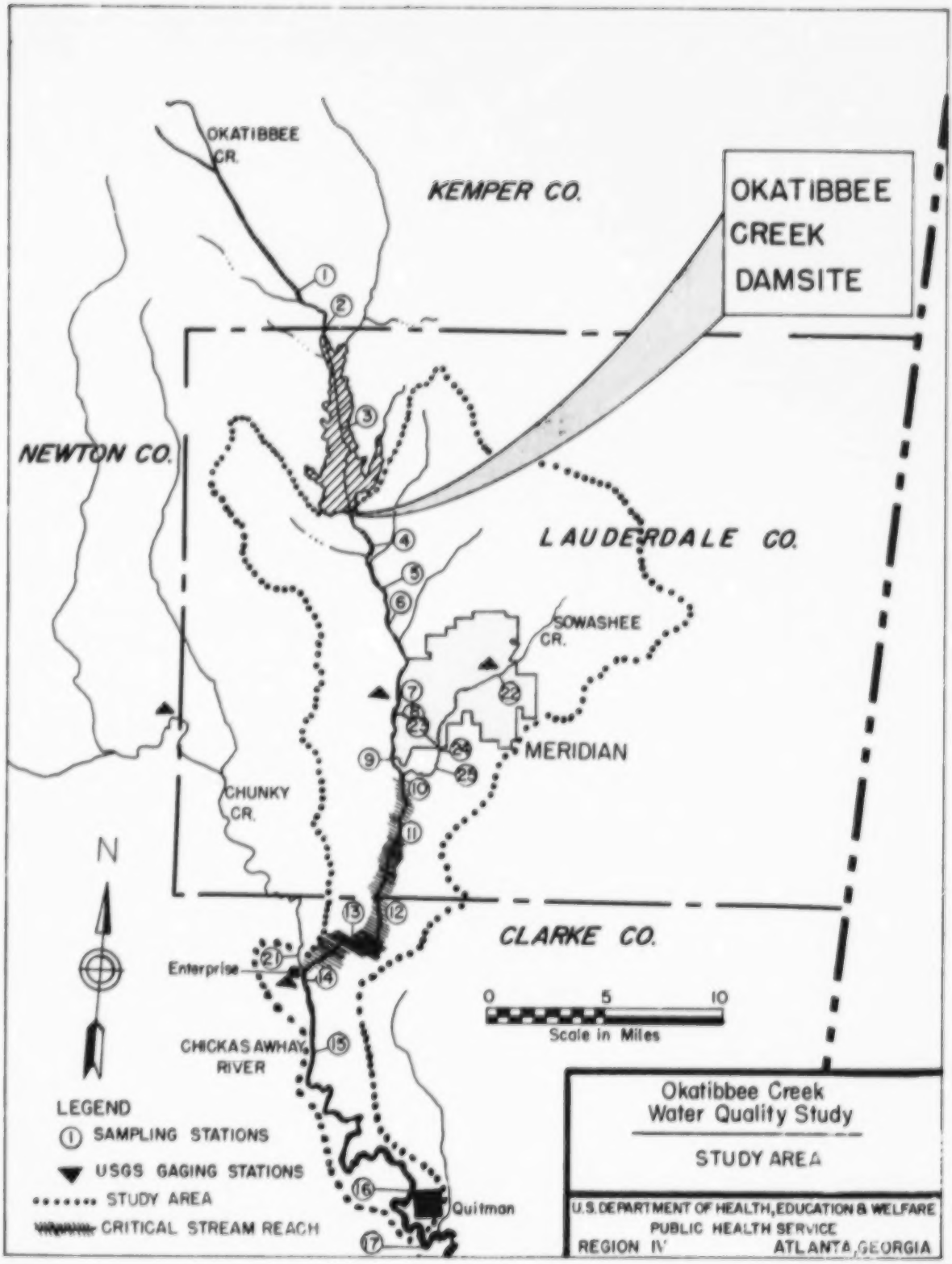
OKATIBBEE CR.
KEMPER CO.
OKATIBBEE CREEK DAMSITE
NEWTON CO.
LAUDERDALE CO.
SOWASHEE CR.
MERIDIAN
CHUNKY CR.
N
CLARKE CO.
Enterprise
0 5 10
Scale in Miles
CHICKASAWHAY RIVER
LEGEND
① SAMPLING STATIONS
▼ USGS GAGING STATIONS
..... STUDY AREA
CRITICAL STREAM REACH
Quitman
Okatibbee Creek
Water Quality Study
STUDY AREA
U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA

FIGURE 2